

Continuous Monitoring for PM Species Pilot Studies & Future Plans

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Beth Oswald

EPA/OAR/OAQPS

Outline

- Background
- Sunset Carbon OC/EC Monitor
- Planned EPA Experiments
- Pilot Study
- Future Plans

Background

- CSN currently has >180 sites
- Each collects 24-hr filters analyzed for:
 - Elements and Mass,
 - Ions
 - OC/EC
- OC/EC Samples Collected onto Quartz Filters Every Third or Sixth Day and Shipped to RTI for Analysis
- Cost of Sample Prep, Shipping & Analysis for Carbon ~\$2M/yr
- OAQPS Committed to Evaluation of New Continuous Monitoring Technologies in an effort to:
 - Move towards continuous, higher time resolution samples
 - Reduce need for expensive, time consuming, filter based sampling



Sunset OC/EC Monitor



- Semi-Continuous OC/EC Instrument is Field Deployable Alternative to Integrated Filter Collected and Lab Analysis
- Provides Time-Resolved OC/EC Analyses on Semi-Continuous Basis with a Temperature Profile Comparable to NIOSH Method 5040

EPA Sunset Evaluation Project

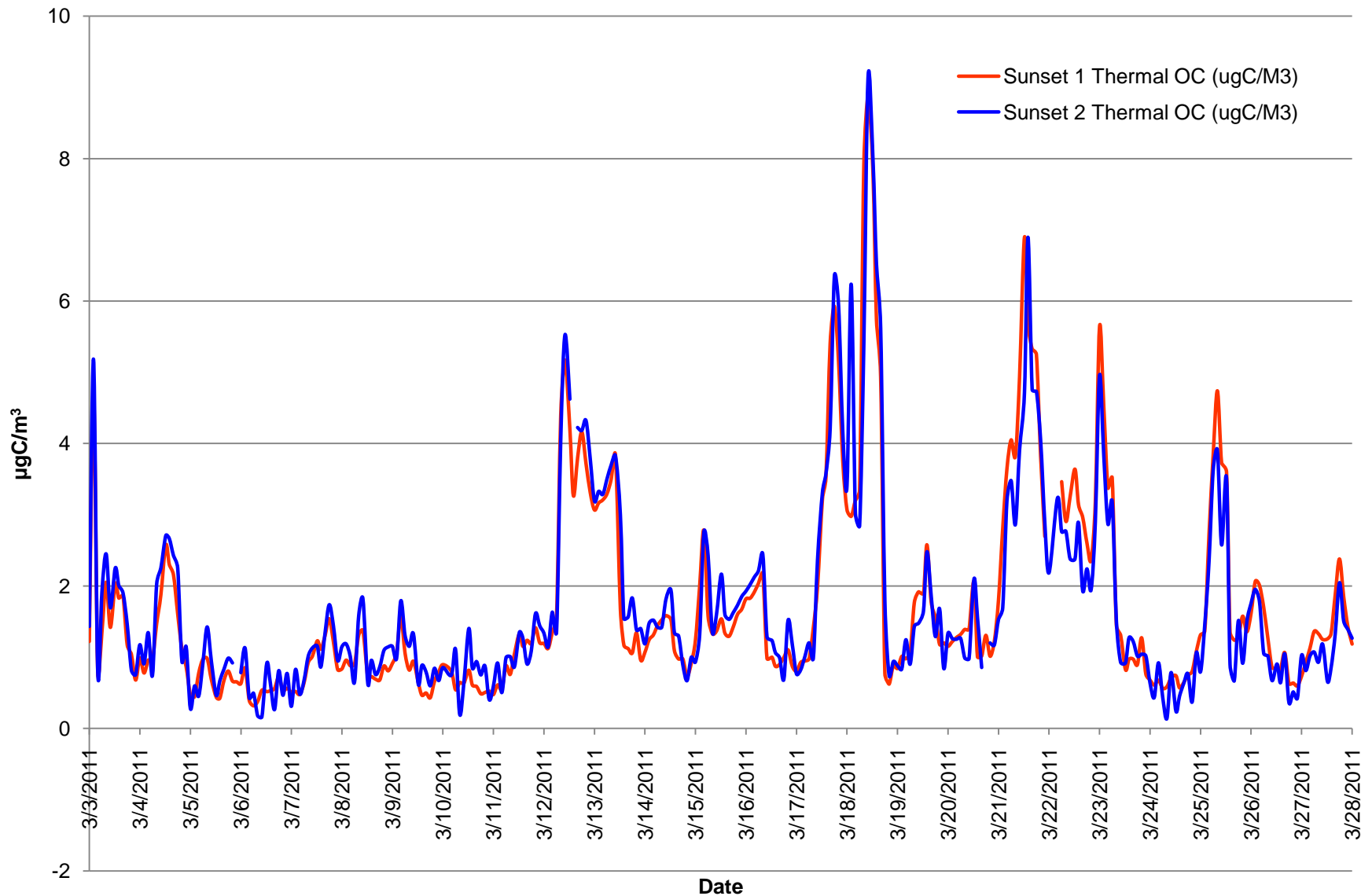
- Will Conduct Several Experiments to Perform an Instrument Evaluation of the Sunset and Data Comparison with the URG 3000N and Magee Scientific Aethalometer
- Experiments will be Conducted at EPA's Ambient Air Innovation and Research Site (AIRS) in RTP, NC
- Primary Study Objectives
 - Gain Understanding of Sunset Instrument (Routine Operations & Maintenance)
 - Determine how to Optimize Operation through Various Experiments
 - Develop an SOP
 - Establish Precision and Detection Limits for the Sunset
 - Determine how well the Sunset Compares with the URG 3000N & Aethalometer



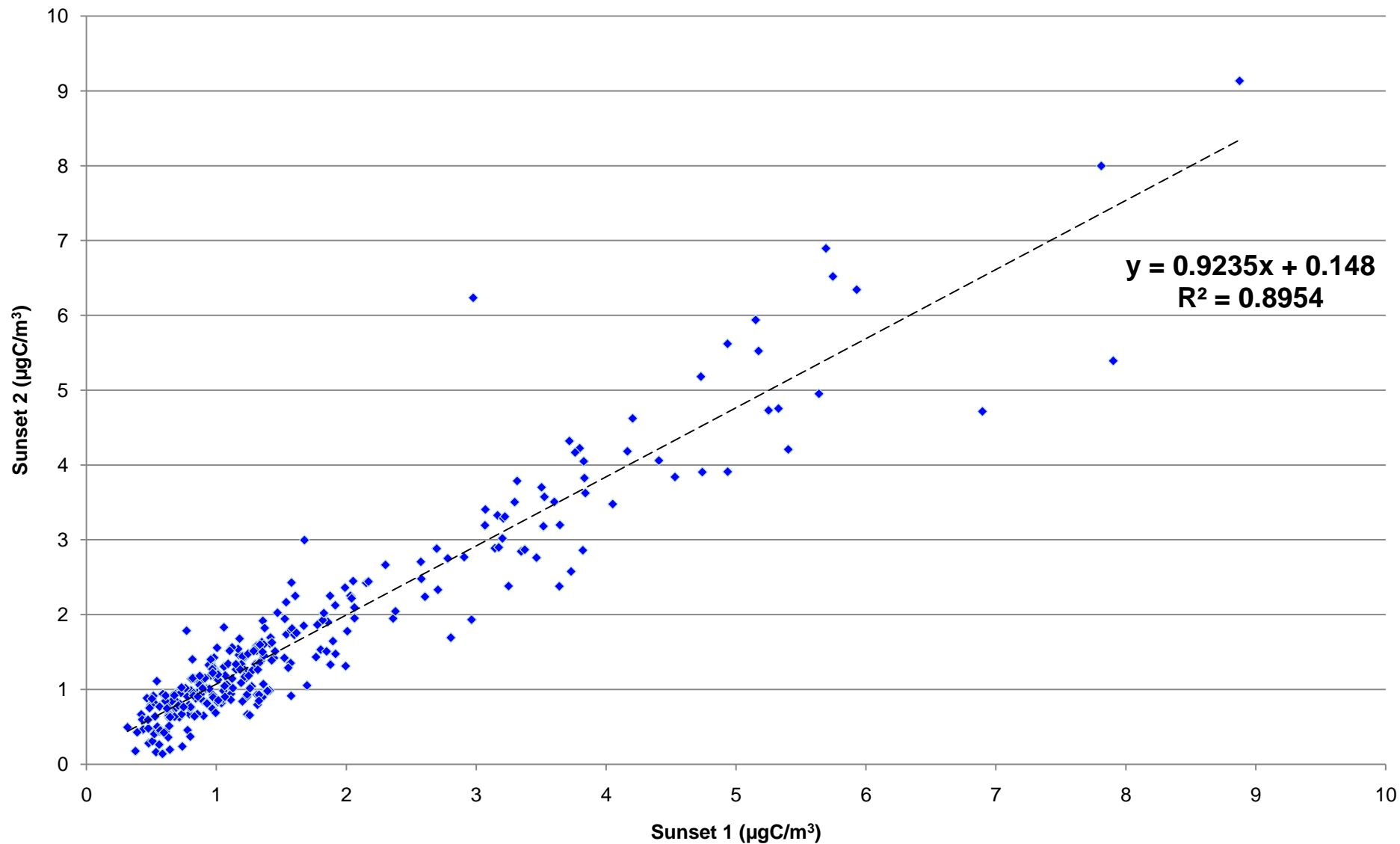
EPA Sunset Evaluation Project

- Study Planned over 17 Weeks
- Four Experiments
 - Collocated Precision & Sensitivity for 1-hr Sampling Period
 - Denuder Comparison & Exploration of OC Artifact
 - Collocated Precision & Sensitivity for 2-hr Sampling Period
 - Comparison of Sunset with URG 3000N and Aethalometer
- Results Important for SOP Development and Future Project Planning
- Following Slides show Preliminary Results of Data Collected Prior to Start of Project

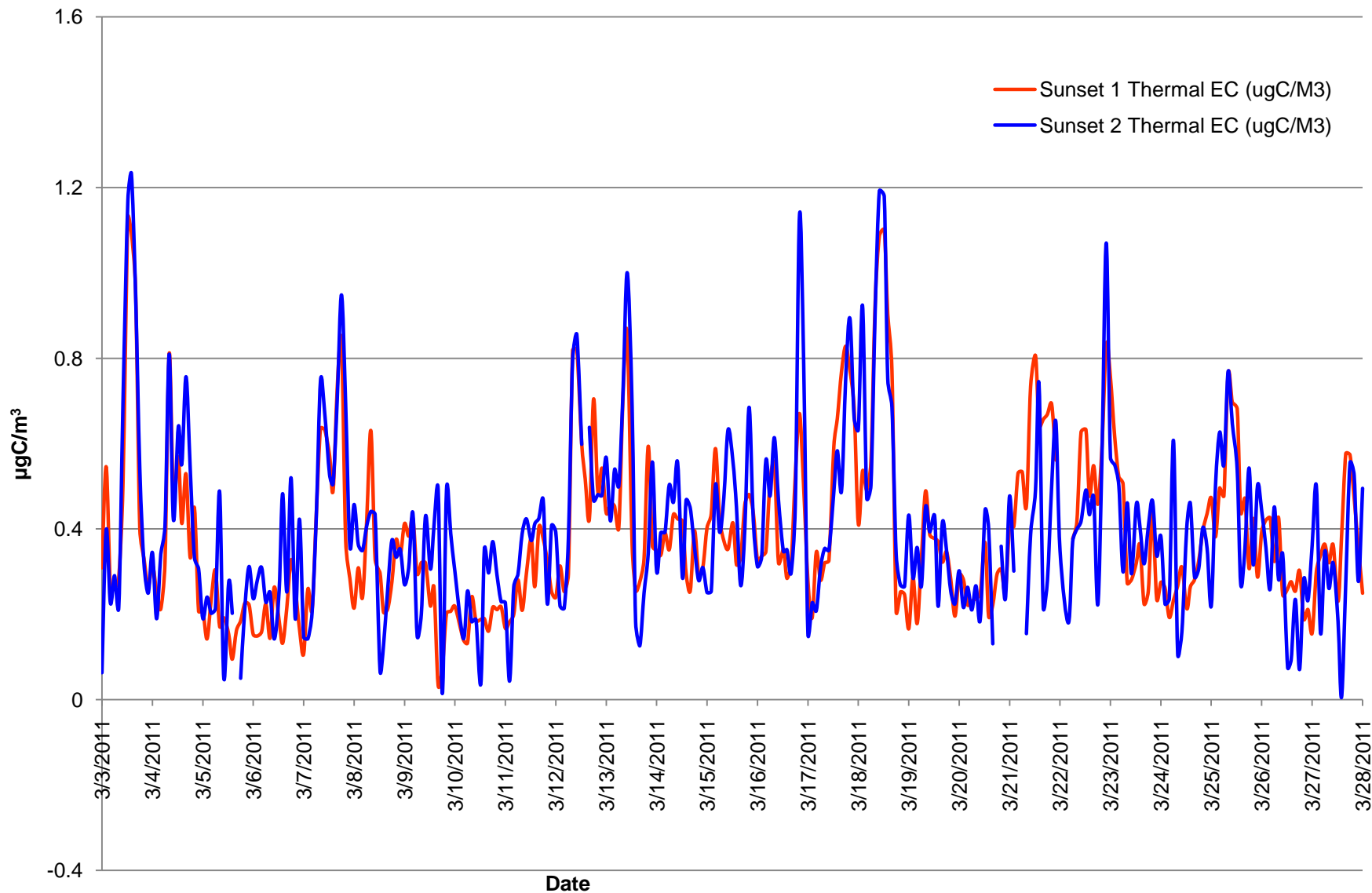
Collocated Sunsets Thermal OC - *Preliminary Results*



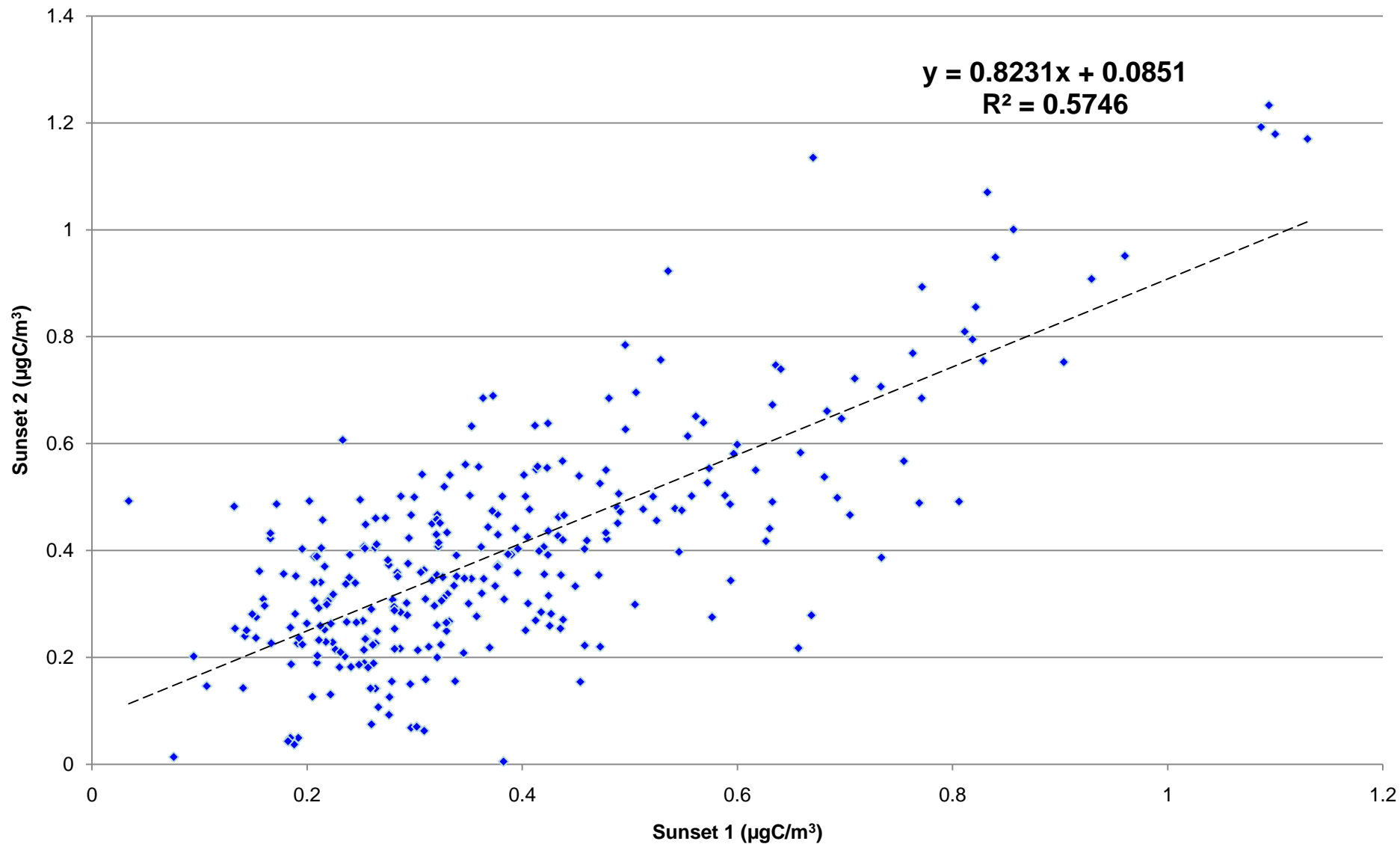
Collocated Sunsets Thermal OC - *Preliminary Results*



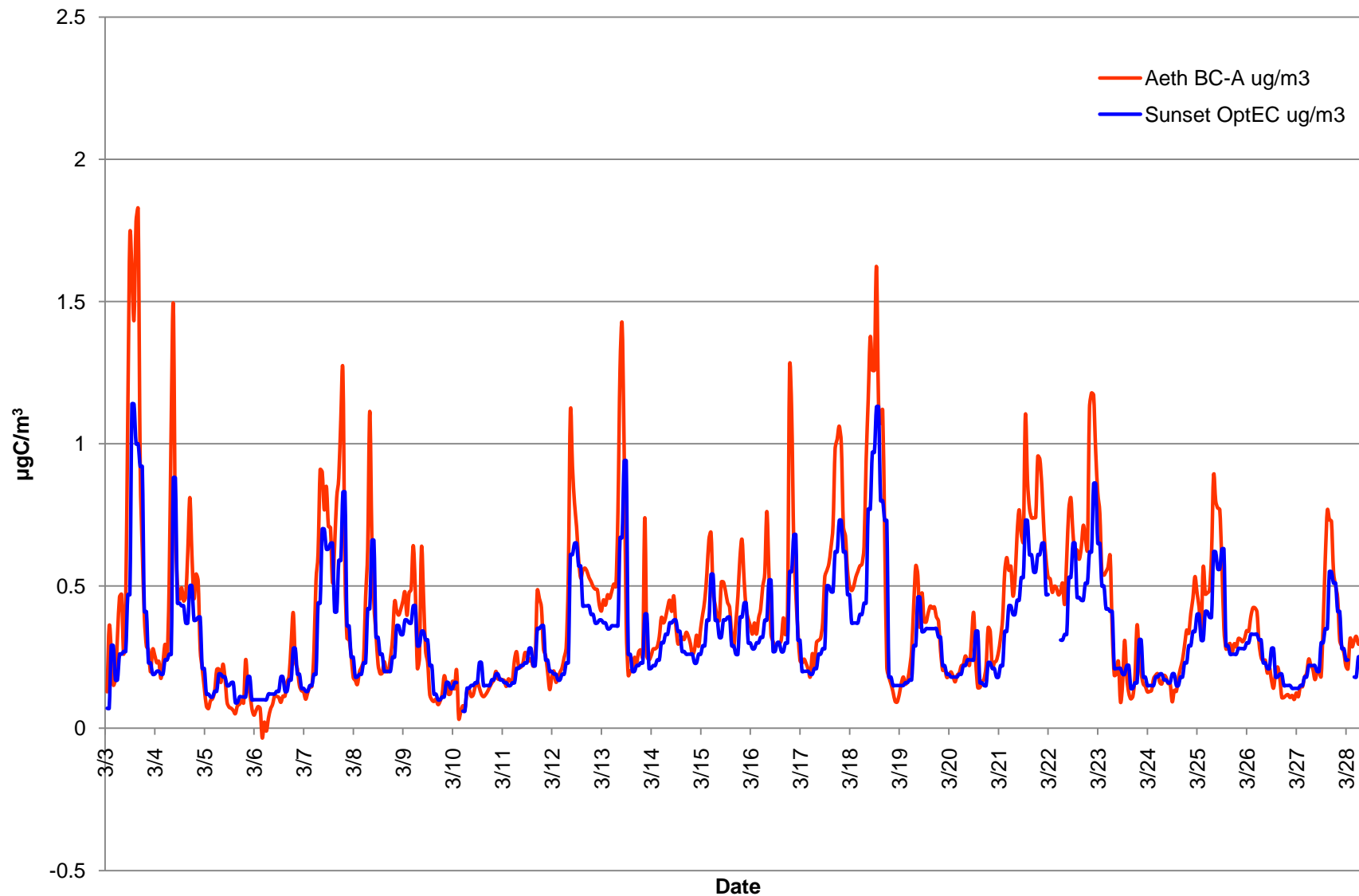
Collocated Sunsets Thermal EC - *Preliminary Results*



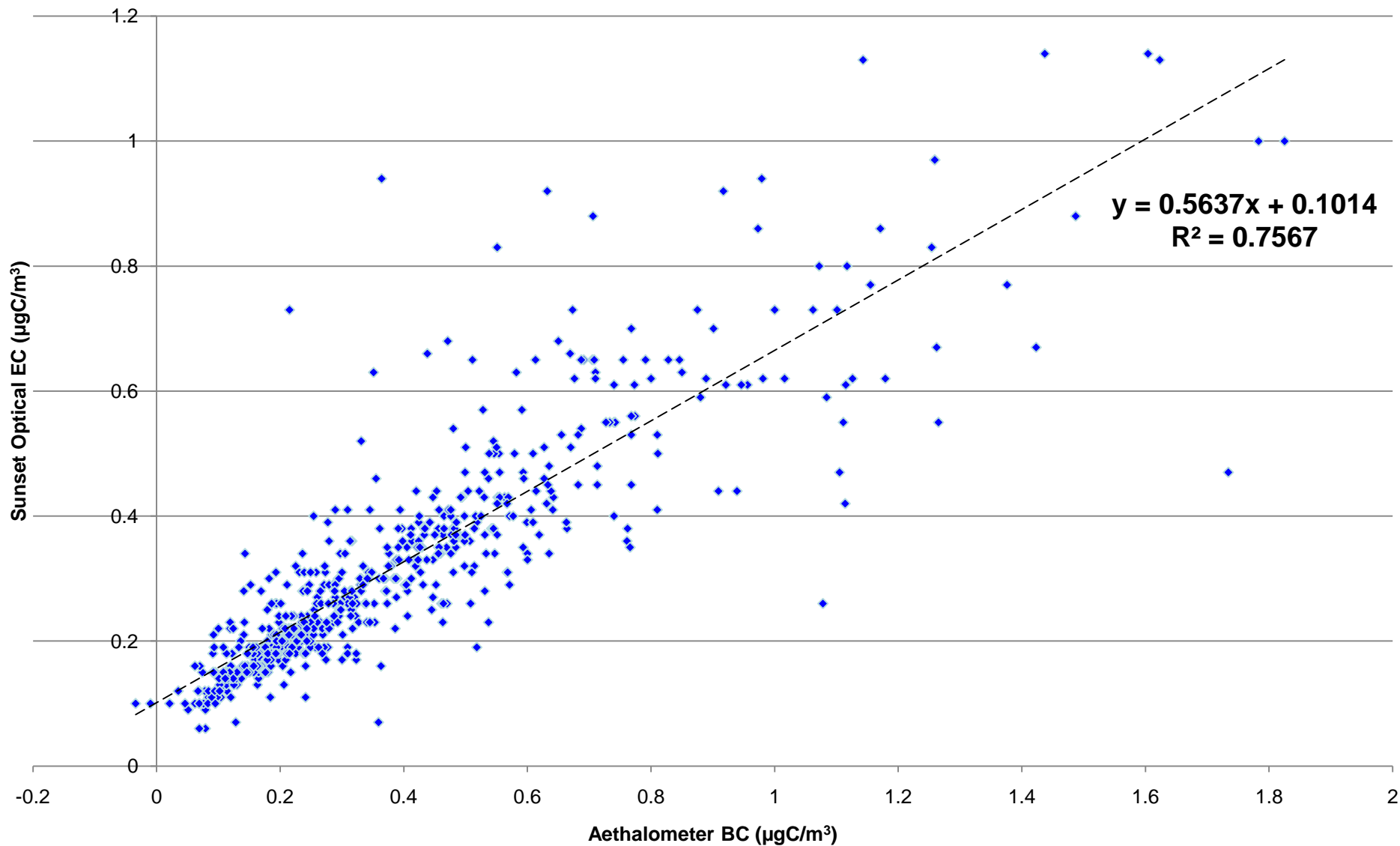
Collocated Sunsets Thermal EC - *Preliminary Results*



Aethalometer & Sunset - *Preliminary Results*



Sunset vs. Aethalometer - *Preliminary Results*



Pilot Study

- Will Deploy 8 Sunsets throughout United States, Potential Sites Include:
 - AIRS (RTP, NC)
 - Chicago, IL
 - Los Angeles, CA
 - Houston, TX
 - Seattle, WA
 - Atlanta, GA
- Would like to Incorporate Data from Sites Already Running Sunsets
 - Dearborn, MI
 - New York, NY
 - Pinnacle State Park, NY



Future Plans

- Based on Results of Pilot Study, may Expand Use of Sunset OC/EC Instruments in Ambient Air Monitoring Networks
- Evaluate other Continuous Speciation Monitoring Technologies, for Example:
 - Cooper Xact™ Ambient Metals Monitor (AAM)
 - Thermo 5020 Sulfate Monitor

Additional Info - Theory of Analysis

- Quartz Filter Punch Mounted in Instrument
- Samples Collected for Desired Period of Time (30min-12hr)
- Oven Purged with Helium, Stepped-Temperature Ramp to 850°C
- Thermally Desorbs Organic Compounds and Pyrolysis Products into MnO₂ Oxidizing Oven
- Carbon Fragments Quantitatively Converted to CO₂ gas
- CO₂ Measured by Self-Contained Non-Dispersive Infrared (NDIR) Detector as Organic Carbon
- Second Temperature Ramp Initiates in Oxidizing Gas Stream (He/O₂)
- Carbon Oxidizes off Filter, Flows through Oven and Converts to CO₂
- CO₂ Measured by NDIR Detector as Elemental Carbon



Additional Info - Theory of Analysis

- Correction for EC - Charring of OC during Pyrolysis Could Result in Artificially Low OC and High EC
 - Monitors Absorbance of Tuned Laser Diode and Reassigns EC to OC up Until the Point when Absorbance Equals the Original Value*
- Uses Sensitive Linear Detector for Analysis - Historically have used Flame Ionization Detectors (FID) until recent Self-Contained NDIR Detector
 - Calibrations Constant for up to One Year
 - Eliminates Requirement for Hydrogen at Field Site
- Methane External Standard - Fixed Volume Loop used to Inject an External Standard at the end of Every Analysis
 - Every Sample Correlated to External Standard Injected with each Analysis
 - Normalizes out small variations in instrument performance